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To: Mr. R.A. Wright
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Attn: Mr. A. Dmochowski

WESTERN REGION MACHINE SHOP
SUPPLEMENTARY SOILS INVESTIGATION

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INTRODUCTION

At the request of the Hydraulic Plant Equipment Department, a further soils investigation was performed along the SAB GS intake canal. Data from this investigation was required to assist in selecting a site for the Western Region Machine Shop building. As the building will incorporate a large area for working on runners weighing about 100 tons, heavy floor and column loads are anticipated.

A preliminary soils investigation has established a suitable area for the proposed machine shop. This site was recommended because the surface soils appeared best suited to support heavy floor loads, because of the shallow depth to bedrock to support heavy foundations (if necessary) and because the area was found to be relatively free of wet or caving soils that may cause construction difficulties. Additional soil testing was recommended to confirm soil bearing capacity pressures, to determine the compressibility of soil beneath the floor slab, to prove the bedrock and to confirm the construction conditions.

Recently, 11 boreholes were augered to assist in deciding between two building locations on the same site.

FIELD AND LABORATORY WORK

Engineering boreholes were performed using hollow stem and flight augers. A total of 11 holes were augered in the locations shown on Figure 1. Boreholes 29 to 37 were augered to refusal without sampling in order to provide data on the bedrock location. Boreholes 38 and 39 provided soil samples for laboratory testing. Borehole 39 was cored to prove the bedrock

location, in all other boreholes auger refusal is assumed to be bedrock. All boreholes were backfilled upon completion.

Granular soils were generally sampled using the 51 mm OD split spoon sampler advanced by the Standard Penetration Test Method. This test yields the "N" value for the soils being sampled. Cohesive soils were generally sampled by pushing a thin wall 51 mm OD Shelby tube sampler.

The laboratory testing included determination of moisture content, bulk density, shear strength, and soil classification.

SUBSOIL CONDITIONS

The depth to bedrock, and the bedrock elevations, are shown on Figure 1. Figures 2 and 3 show a cross section along the length of the proposed locations. These figures show that the bedrock peaks in height on the west portion of the site and generally is much flatter in profile on the east portion of the site. The bedrock peak on the west portion of the site may be a boulder, however, additional drilling or a test pit to prove the bedrock in this location would be required to determine the exact situation.

Boreholes 38 and 39 provided soil samples for visual inspection and laboratory testing. Detailed results from these two boreholes are shown on the borehole profiles (Figures 4 and 5) and are summarized below. The soils encountered are summarized in Table I.

The reddish brown silt layer that caps the area was confirmed to be fill. This fill is quite variable in density and moisture content. As a result of this variability, some locations in the fill, that are low density and high in moisture content, are compressible. In addition, a rockfill layer was detected in the fill between 0.4 to 1.5 m below the ground surface. Beneath the fill is a stiff grey clayey silt which is followed by a layer of dense reddish brown silt and then a layer of dense brown clayey silt and bedrock. The bedrock is good quality limestone.

The water levels observed in each borehole are plotted on Figures 1 and 2. Generally, the water table is near the surface of the bedrock. No caving soils were observed in any of the boreholes and this suggests that caving will not be a problem during construction

DISCUSSION

The depth to bedrock is most uniform on the east portion of the site. The overlying fill is variable in density and moisture content, contains compressible zones and contains a rockfill layer. In addition, the near surface soils are predominantly silt and may cause frost heave problems if precautions are not considered.

On a preliminary basis, floor loads on the silt fill of 100 kPa are recommended. The desired floor loadings could not be supported on the existing ground surface without unacceptably high amounts of settlement. However, it would be possible to improve the bearing capacity of the fill.

by compaction or surcharging, or by establishing the floor level on deeper more competent soils.

On a preliminary basis, footing loadings of 200 kPa are recommended. These footings may be safely established on the clayey silt below the fill, however, the footings would require field inspection to confirm suitable bearing capacity before pouring. In general, the deeper soils are better suited to load bearing.

Some consolidation of the grey clayey silt is expected. Settlements in the fill will vary widely in magnitude unless the quality of the fill is improved. These settlements will be immediate and no long term consolidation is expected in the fill. Settlements in the remaining soils are expected to be very small. Design loads and locations are required to permit calculation of expected settlements of the floor slab and any footings founded on soil.

Once the exact location has been chosen, it is recommended that further soils investigation be performed. These soils investigations would be intended to (a) provide samples of the grey clayey silt for consolidation testing to assist in predicting consolidation settlements (b) provide samples of the excavated rock which is contained in the fill and (c) provide an opportunity to prove bedrock on the west portion of the site. This investigation would consist of 3 boreholes, whose locations are shown on Figure 6, which are sampled every 1.5 m to bedrock. In addition, two test pits are suggested in the locations shown on Figure 6. These test pits would provide an opportunity to expose and examine the excavated rock in the fill. In addition, the test pits would permit the bedrock to be proven near the previous boreholes 30 and 30A. This location is chosen because bedrock has been previously inferred at a depth of approximately 1.2 meters.

CONCLUSIONS

The subsurface soil conditions have been documented and summarized in this report. The fill was observed to be compressible and to contain a rockfill layer. The available bearing capacity for the floor loads and spread footings have been reported. The final foundation bearing pressures and floor slab design will be established following the detailed soil investigation. The location of the bedrock has been proven in one borehole and inferred in 10 others. No problems are anticipated with wet or caving soil during construction.

Both of the locations would be suitable as building locations for the Western Region Machine Shop.

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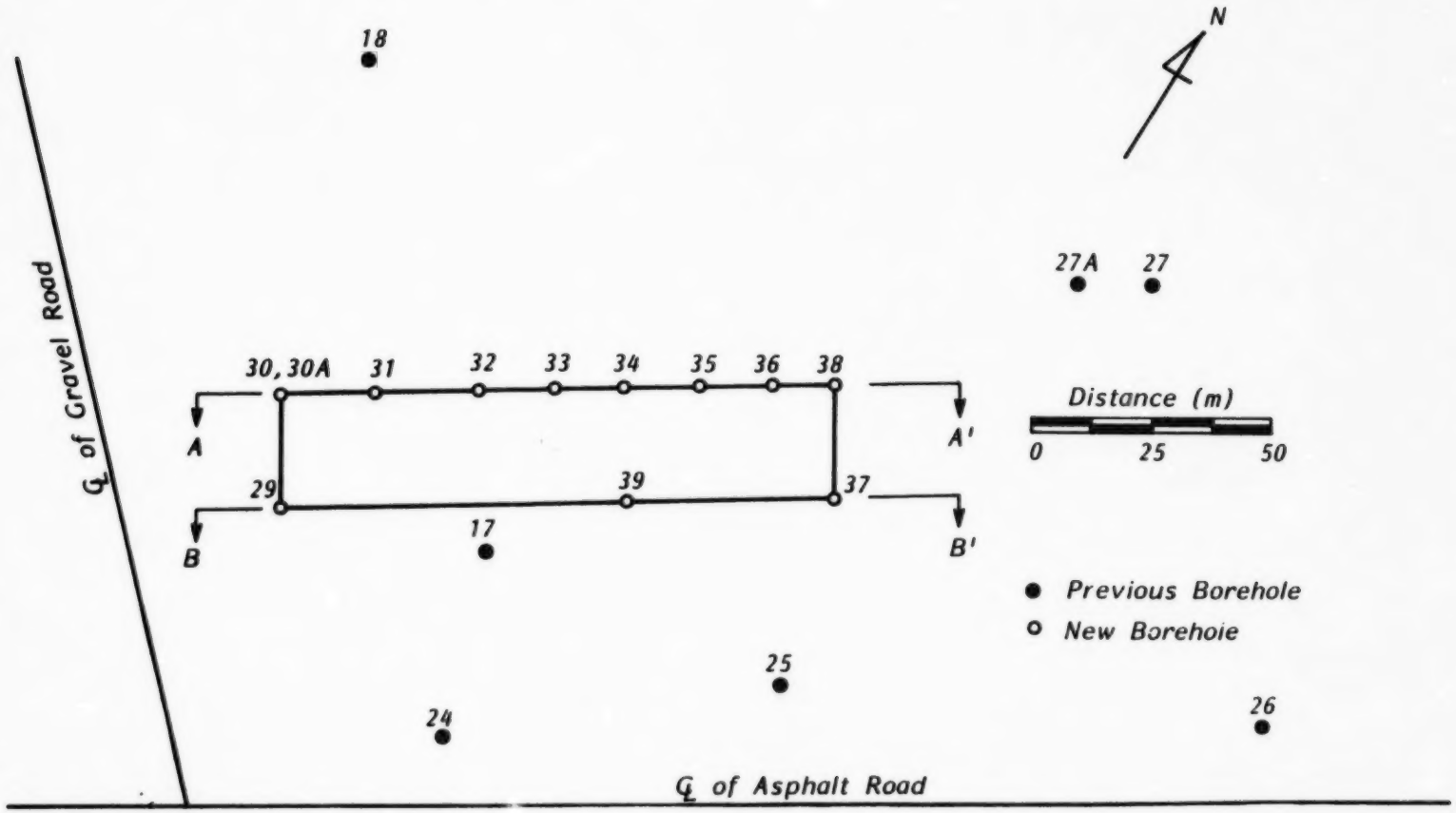
JBE:LM

TABLE I

Soil Summary for Boreholes 38 and 39

Soil	Average Thickness (m)	Depth of Top of Soil Unit (m)	Average Density (kg/cu.m)	Average Water Content (%)	Average Shear Strength (kPa)
Fill	3.8	0	2089*	21.3*	96*
Grey Clayey Silt	1.5	3.3	2033	20.4	128
Reddish Brown Silt	4.1	4.8	2073	20.5	87
Brown Clayey Silt	0.4	8.9	2086	19.8	121
Limestone Bedrock	N/A	9.3	N/A	N/A	N/A

* Soil shows wide variation in physical properties



Borehole No.	17	18	24	25	26	27	27A	29	30	30A	31	32	33	34	35	36	37	38	39
Bedrock Elevation (ft)	576.68	-	576.45	576.26	570.07	599.96	600.03	583.10	601.87	603.35	581.10	579.65	577.92	579.08	578.91	576.58	573.75	578.78	578.58
Depth to Bedrock (ft)	9.60	5.61	8.05	8.56	8.99	2.07	2.01	25.49	5.08	3.61	27.49	27.06	31.32	30.47	30.67	33.00	35.49	30.80	30.01
Depth to Bedrock (m)	2.93	1.71	26.40	28.10	29.50	6.80	6.60	7.77	1.55	1.10	8.38	8.25	9.55	9.29	9.35	10.06	10.82	9.39	9.15

FIGURE 1

WESTERN REGION MACHINE SHOP
NEW BOREHOLES TO PROVE BEDROCK

172163-RD

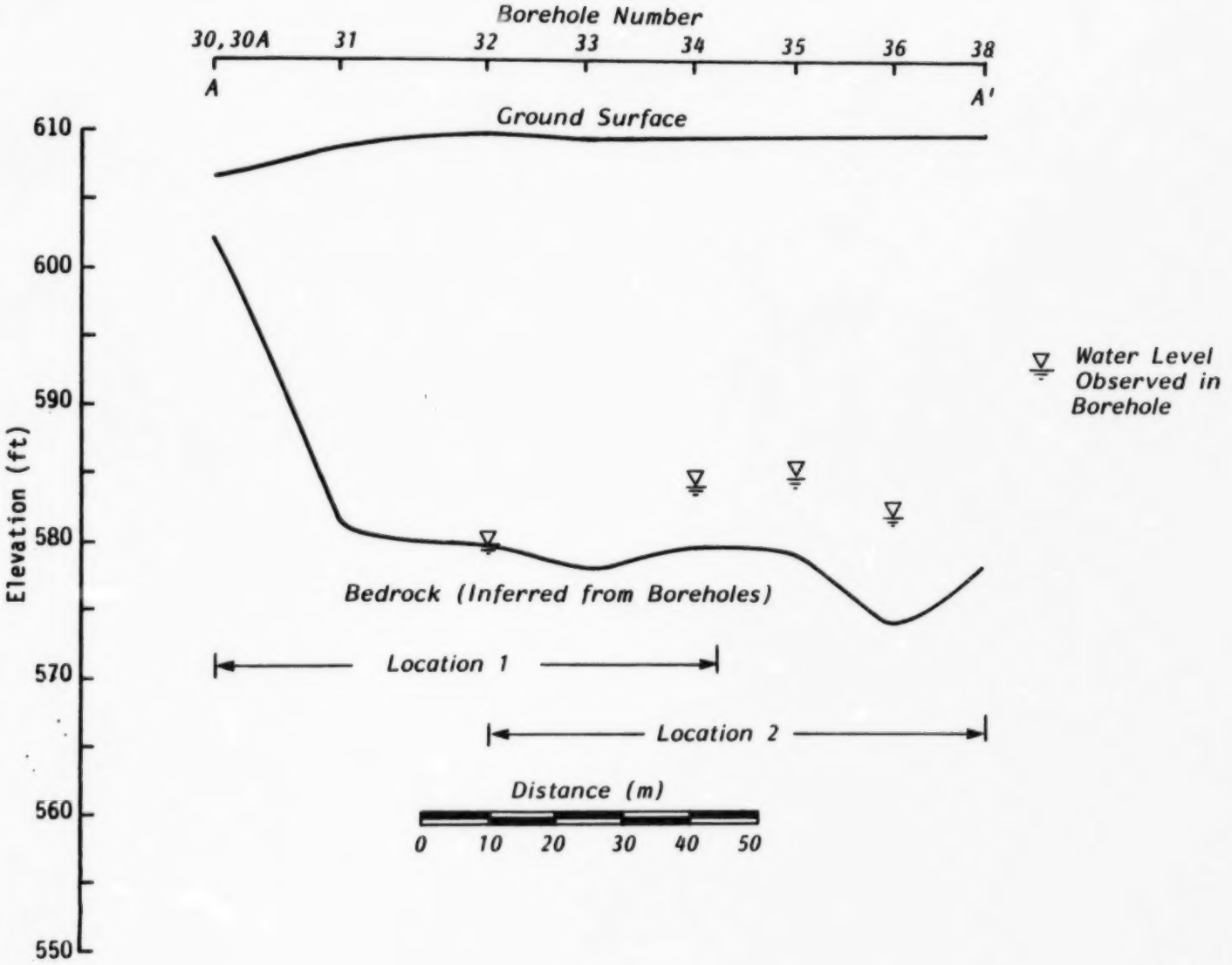


FIGURE 2

SECTION A-A, INTERPRETED BEDROCK PROFILE

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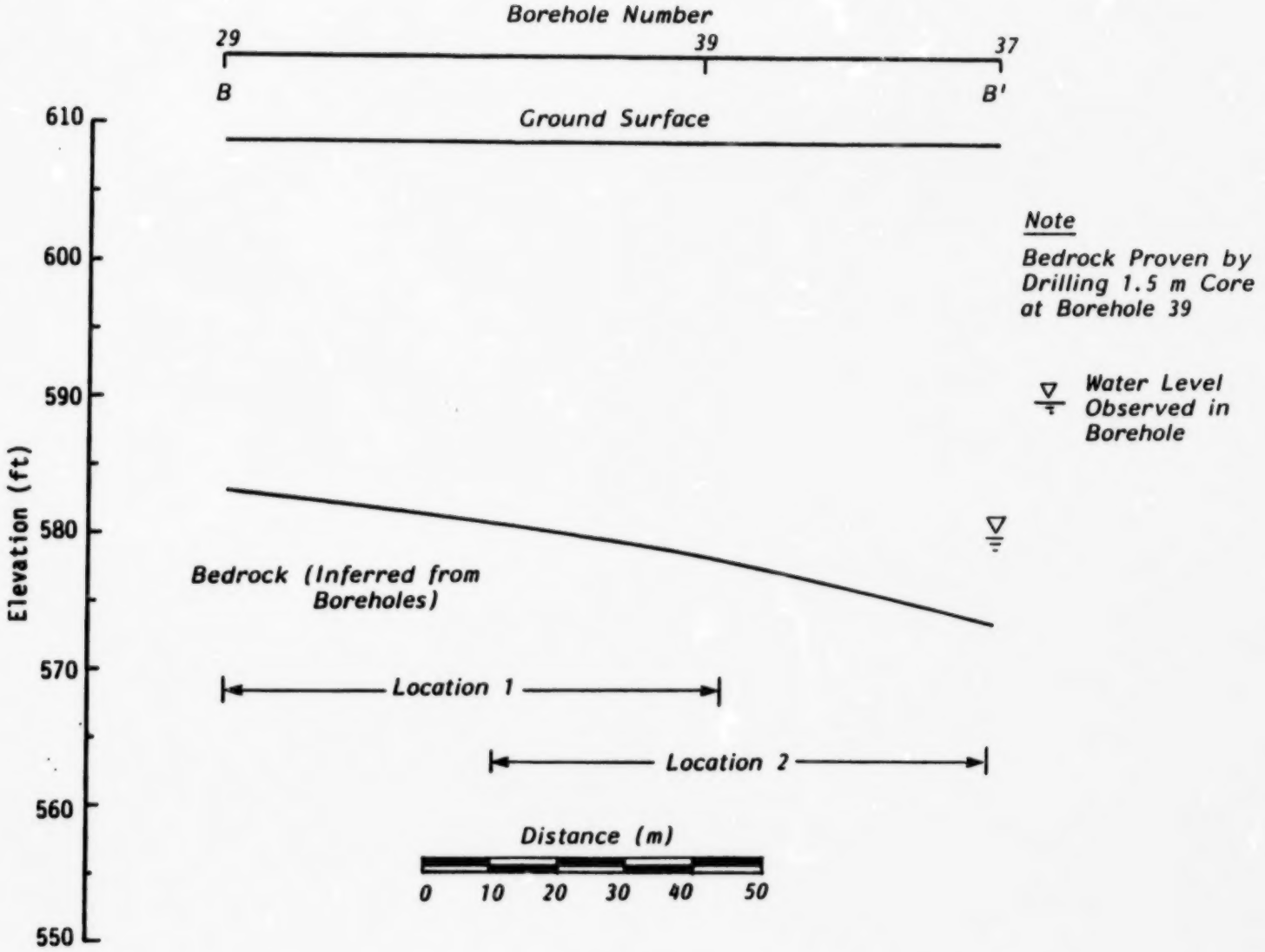

FIGURE 3

SECTION B-B' - INTERPRETED BEDROCK PROFILE

172165-RD

PROJECT ... WESTERN REGION MACHINE SHOP ... HOLE TYPE FLIGHT AUGERS ... OBSERVER D.W.

LOCATION ... SEE FIGURE 1 ... HOLE SIZE 4½" ... COMPILED J.B.

... DIP ... DRILLED JULY 29/86 ... CHECKED ...

DATUM FROM SITE PLAN DWG NO D.O. 33111E ... BEARING ... DRAWN AUG 12/86 ... APPROVED ...

BORING DATA						BORING LOG	WATER INF.		FIELD TESTS		LABORATORY TESTS					
SCALE - METRES	ELEV / DEPTH	(1) SAMPLE NO	(2) SAMPLE TYPE	(3) 'N' VALUE per 0.3m / RQD - %	(4) WATER LEVEL and CAVING / W.R	(5) DESCRIPTION / (6) REMARKS	(7) OBSERVATION WELL DATA	(8) 'k' soil/rock cm/s / WATER PRESS. TEST	(9) SPECIAL TESTS TYPE	(9) SPECIAL TESTS RESULTS	NATURAL DENSITY kg/m³	MOISTURE CONTENT - %	(10) SHEAR STRENGTH kPa TYPE	(10) SHEAR STRENGTH kPa RESULTS	(11) SPECIAL TESTS TYPE	(11) SPECIAL TESTS RESULTS
1						Silt with a Little Clay, Fine to Coarse Sand and Gravel, Reddish Brown, Compact. Fill Material.										
2		1	⊠	27							2218	14.3	u/c	143		
3		2	⊠	25							2074	14.9				
4						4.04 m Clayey Silt, Grey, with a trace of Fine Sand, Stiff.										
5		3	■	PUSH		5.56 m					2055	20.6	u/c	136		
6		4	■	PUSH		Silt, Reddish Brown with a little Clay and Fine Sand, Dense, Damp.					2081	19.6	u/c	77		
7																
8		5	⊠	63		8.61 m					2083	19.4	u/c	97		
9		6	⊠	60 for 0.1 m		Clayey Silt, Brown with Trace to Little Fine and Coarse Sand and Gravel. Dense, Damp.					2086	19.8	u/c	121		
10						End of Hole - Bedrock (Inferred)										

GEOTECHNICAL DATA SHEET

hole no 38 ... Fig 4

sheet 1 of 1

PROJECT ... WESTERN REGION MACHINE SHOP ... HOLE TYPE HOLLOW STEM ... OBSERVER D.W.

LOCATION ... SEE FIGURE 1 ... HOLE SIZE 6" ... COMPILED J.B.

DIP ... DRILLED ... CHECKED

DATUM FROM SITE PLAN DWG NO D.O. 33111E ... BEARING ... DRAWN ... APPROVED

BORING DATA						BORING LOG	WATER INF.		FIELD TESTS		LABORATORY TESTS					
SCALE - METRES	ELEV / DEPTH	(1) SAMPLE NO	(2) SAMPLE TYPE	(3) 'N' VALUE per 0.3m / RQD - %	(4) WATER LEVEL and CAVING W.R	(5) DESCRIPTION	(6) REMARKS	(7) OBSERVATION WELL DATA	(8) 'k' soil/rock cm/s WATER PRESS. TEST	(9) SPECIAL TESTS TYPE	(9) SPECIAL TESTS RESULTS	NATURAL DENSITY kg/m³	MOISTURE CONTENT - %	(10) SHEAR STRENGTH kPa TYPE	(10) SHEAR STRENGTH kPa RESULTS	(11) SPECIAL TESTS TYPE	(11) SPECIAL TESTS RESULTS
1						Silt with a Little Clay, and Fine Sand, Reddish Brown, Compact, Damp.											
2		1	☒	16								1976	29.6	u/c	49		
3						2.51 m Clayey Silt, Grey Brown, Trace of Fine Sand and Organics, Stiff, Damp.											
4		2	☒	17								2011	26.4	u/c	121		
5						4.04 m Silt, Reddish Brown, Trace to Little Clay and Fine Sand.						2066	20.3				
6		3	☒	29									21.3				
7		4	☒	20													
8		5	☒	78								2064	22.1				
9						9.15 m Limestone Bedrock. Proven at 9.15 m.											
10				82.6%													
11						End of Hole											
12																	
13																	
14																	
15																	

dwg no 200618-RD

GEOTECHNICAL DATA SHEET

hole no 39

Fig 5

sheet 1 of 1

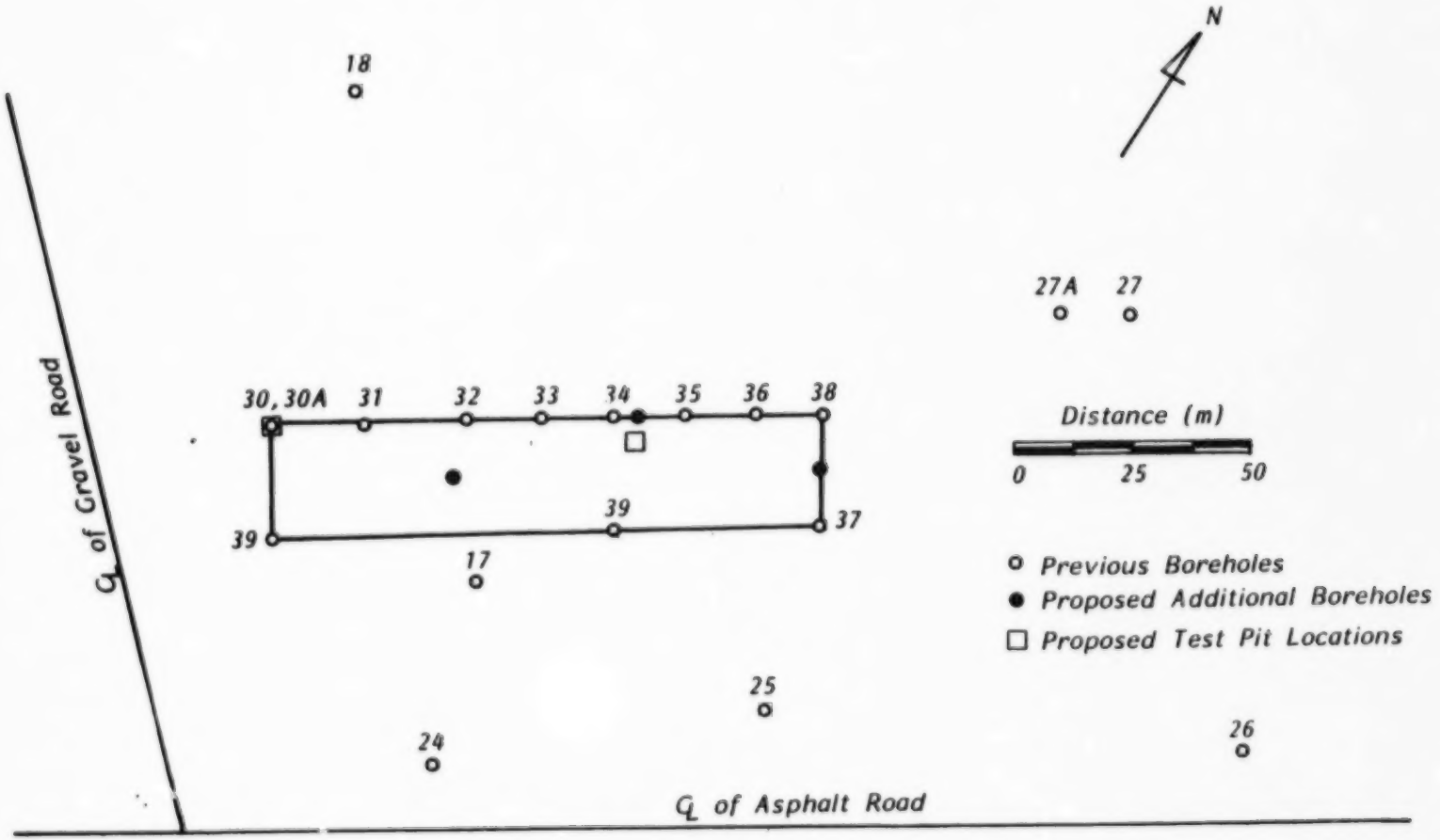

FIGURE 6

WESTERN REGION MACHINE SHOP
LOCATIONS OF RECOMMENDED ADDITIONAL BOREHOLES

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